Quick Start & Field Reference Guide

PLM™ Series

Powered Loudspeaker Management™ systems

LAB.GRUPPEN

Rev 1.3.0

Item: QSG-PLM

1. Important Safety Instructions

Before using the device, be sure to carefully read the Safety Instructions. Keep this document with the device at all times.

1.1 Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Clean only with a dry cloth.
7. Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
10. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.

12. Use only with a cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
13. Unplug this apparatus during lightning storms or when unused for long periods of time.
14. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
15. Use the mains plug to disconnect the apparatus from the mains.
16. WARNING: To reduce the risk of fire of electric shock, do not expose this apparatus to rain or moisture.
17. Do not expose this equipment to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the equipment.
18. The mains plug of the power supply cord shall remain readily operable.
19. Do not connect the unit's output to any other voltage source, such as battery, mains source, or power supply, regardless of whether the unit is turned on or off.
20. Do not remove the top (or bottom) cover. Removal of the cover will expose hazardous voltages. There are no user serviceable parts inside and removal may void the warranty.
21. An experienced user shall always supervise this professional audio equipment, especially if inexperienced adults or minors are using the equipment.
22. The US National Differences clause 16.3 requires that network cables must be flame rated VW-1.

To prevent electric shock do not remove top or bottom covers. No user serviceable parts inside, refer servicing to qualified service personnel.

À prévenir le choc électrique n'enlevez pas les couvercles. Il n'y a pas des parties serviceable à l'intérieur, tous reparations doit etre faire par personnel qualifié seulment.

To completely disconnect this equipment from the AC mains, disconnect the power supply cord plug from the AC receptacle. The mains plug of the power supply cord shall remain readily operable.

Pour démonter complètement l'équipement de l'alimentation générale, démonter le câble d'alimentation de son réceptacle. La prise d'alimentation restera aisément fonctionnelle.

1.2 Standards

This equipment conforms to the requirements of the EMC Directive 2004/108/EC and the requirements of the Low Voltage Directive 2006/95/EC.

Standards applied: EMC Emission
EN55103-1, E3
EMC Immunity EN55103-2, E3, with S/N below 1% at normal operation level.
Electrical Safety EN60065, Class I

This equipment is tested and listed according to the U.S. safety standard ANSI/ UL 60065 and Canadian safety standard CSA C22.2 NO. 60065. Intertek made the tests and they are a Nationally Recognized Testing Laboratory (NRTL).

1.3 Explanation of Graphical Symbols

The lightning bolt triangle is used to alert the user to the presence of un-insulated "dangerous voltages" within the unit's chassis that may be of sufficient magnitude to constitute a risk of electric shock to humans.

The exclamation point triangle is used to alert the user to presence of important operating and service instructions in the literature accompanying the product.

1.4 WARNING

To reduce risk of fire or electric shock, do not expose this apparatus to rain or moisture.
Pour réduire les risques de blessure ou le choc électrique, n'exposez pas l'appareil à la pluie ou à l'humidité.

Do not expose this system/apparatus to dripping or splashing and ensure that no objects filled with liquids, such as vases, are placed on the apparatus.
L'appareil ne doit pas être exposé à des egouttements d'eau ou des éclaboussures et de plus qu'aucun objet rempli de liquide tel que des vases ne doit pas être placé sur l'appareil.

This apparatus must be connected to a mains socket outlet with a protective earthing connection.
Cet appareil doi t être raccordé á une prise de courant qui est branchée à la terre.

The mains plug is used as a disconnect device and shall remain readily operable.
Lorsque la prise du réseau d'alimentation est utilisés comme dispositif de déconnexion, ce dispositif doit demeuré aisément accessible.

1.5 CAUTION

To reduce the risk of fire or electric shock, do not remove screws. No user-serviceable parts inside.
Refer servicing to qualified service personnel.
Pour réduire le risque d'incendie ou de choc électrique, ne pas retirer les vis. Aucune pièce réparable par l'utilisateur. Confier l'entretien àpersonnel qualifié.

1.6 FCC Compliance Notice (Radio Interference)

A sample of this product has been tested and complies with the limits for the European Electro Magnetic Compatibility (EMC) directive. This equipment has also been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference from electrical equipment. This product uses radio frequency energy and if not used or installed in accordance with these operating instructions, may cause interference to other equipment, such as radio receivers.

This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Check if the affected unit complies with the EMC limits for immunity, (CE-labeled). If not, address the problem with the manufacturer or supplier. All electrical products sold in the EC must be approved for immunity against electromagnetic fields, high voltage flashes, and radio interference.
- Consult the dealer or an experienced radio/TV technician for help.

1.7 User Responsibility

1.7.1 Mains Connection Grounding

⚠ Your apparatus must be connected to a grounded socket outlet.

1.7.2 Speaker Output Hazard on Amplifiers

⚠ Amplifiers are capable of producing hazardous output voltages. To avoid electrical shock, do not touch any exposed speaker wiring while the amplifier is operating. The external wiring connected to the speaker terminals shall be installed by a qualified person, or ready-made leads or cords of appropriate capacity shall be used.

⚠ As the power output channels on amplifiers produce high voltage, do not connect or disconnect speaker cables when the mains power is on.

1.7.3 Speaker Damage

Amplifier apparatus is very powerful and can be potentially dangerous to both loudspeakers and humans alike. Many loudspeakers can be easily damaged or destroyed by overpowering them. Always check the speaker's continuous and peak power capabilities. Although the amplifiers attenuators can be used to reduce the overall gain, an increase of the input signal can result in full output power, which may cause damage to connected speakers.

1.7.4 Maintenance

For safe and reliable operation, the dust filters on both sides of the front panel, behind the grilles, should be removed and cleaned regularly to ensure maximum airflow through the device.

⚠ If the dust filters are not maintained there will be safety risks; for example, high internal temperatures could ignite the dust and start a fire. There is also a risk that the unit will malfunction since it is dependent on constant airflow from front to rear. If the dust filters are not clean and the unit malfunctions, any resulting problems will not be covered by the warranty.

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2. Welcome

2.1 Introduction

Thank you for choosing the Lab.gruppen PLM Series of Powered Loudspeaker Management systems for your sound reinforcement needs. We are confident that you will be pleased with the performance, unique features, configuration flexibility, reliability, and long-term durability offered by this product.

For fast installation and use of this product, your welcome package includes a printed copy of the PLM Series Quick Start & Field Reference Guide which contains the information required to safely install the product and place it in service. Control and editing features are accessible via the front panel interface or via the included Lake Controller software. This document provides a brief introduction to the features and functionality of the PLM Series of Powered Loudspeaker Management systems. Please read through thoroughly to become acquainted with the basic configuration and control options available in these products. Control and editing features are accessible either via the intuitive front panel interface or remotely with the included Lake Controller software package.

In the following sections you'll find the basic information needed to safely install a PLM system and place it in service. However, it is recommended that all documentation on the included CD-ROM is reviewed to ensure familiarity with the various configuration and control options available.

It is recommend that the Quick Start & Field Reference Guide and all product documentation on the included CD-ROM is reviewed to ensure familiarity with the various configuration and control options.

Thank you again for placing your confidence in Lab.gruppen products.

2.2 Main Features

The PLM Series incorporates a number of sophisticated technologies to ensure the best possible performance and many years of reliable operation. The following section summarizes the benefits of each feature; additional information is available in the reference manuals.

2.2.1 Amplifier Platform

The PLM Series power output section has expanded upon Lab.gruppen's robust, road-proven FP+ Series amplifiers. Features in common with the FP+ Series include extraordinary power density, patented Class TD® output stages, Regulated Switch Mode Power Supply (R.SMPS™), the high-efficiency Intercooler® copper-finned cooling system, and a full suite of protection features. Signal inputs are analog, AES digital, and Dante digital audio network; loop-through outputs or redundant pairs are provided for each input type.

Please refer to section 5.3 of the PLM Operation Manual for further information.

2.2.2 Amplifier DSP (Digital Signal Processor)

Various features of PLM Series devices are controlled by the on-board DSP, some of which are summarized in this section.

2.2.2.1 Input Gain (Sensitivity)

Input gain (sensitivity) is set in the digital domain for PLM Series devices, and may be controlled via the Lake Controller software or front-panel interface.

2.2.2.2 ISVPL™

The Inter-Sample Voltage Peak Limiter (ISVPL) tailors each power output to the characteristics of the connected load. Please refer to section 5.3.1 of the PLM Operation Manual for further information.

2.2.2.3 Load Verification & Performance Monitoring

A comprehensive set of proprietary DSP-based tools are provided for load verification and real-time performance monitoring. These functions utilize LoadLibrary, a comprehensive database for each loudspeaker component of the connected load (usually one or more band-limited drivers in a multi-way system).

Using this data and a brief test signal, LoadSmart compares actual response to predicted response, identifying any malfunctioning components or connection errors. During the performance, SpeakerSafe™ monitors real-time load status, including temperatures of the PLM amplifier stages as well as magnets and voice coils of connected loudspeakers. This allows operators to avoid power compression and identify potential problems.

Please refer to the Lake Controller Operation Manual for detailed information on PLM Series load verification and real-time performance monitoring functionality.

2.2.3 Lake Processing and Controller

PLM Series devices integrate seamlessly into the Lake Processing environment and are accessible via the Lake Controller software. Processing modules offer precise settings for gain, delay, crossover settings, equalization and limiting. Lake processing features incorporated in each module include Raised Cosine Equalization™, linear phase crossovers, and LimiterMax™ loudspeaker protection. The Super Module feature allows hardware processing modules in two or more separate devices to function as a single module in the Lake Controller software. Please refer to the Lake Controller Operation Manual for further information.

2.2.4 Analyzer Plug-In

Lake Controller software provides integration with third-party real-time analyzers, providing simultaneous measurement display and EQ adjustment via the Lake Controller. Approved analyzers include Rational Acoustics Smaart 7 and WaveCapture Live-Capture Light or Live-Capture Pro; additional third-party analyzers may be approved in the future.

Please refer to the Lake Controller Operation Manual for further information regarding the Analyzer plug-in and associated functionality.

2.2.5 Dante™ Audio Network

PLM Series devices include Dante digital audio networking as standard. Utilizing the latest advances in Ethernet technology, Dante offers simplified system configuration and extremely low latency while delivering very high quality uncompressed digital audio across the Lake network. The Zen™ automatic configuration feature enables plug-and-play setup without third-party DHCP or DNS servers. Dante is compatible with high-bandwidth networks, allowing large numbers of audio channels to be distributed alongside control and analyzer data.

2.3 Additional Documentation

This document, the PLM Quick Start & Field Reference Guide, serves as a basic introduction to the installation and operation of PLM Series Powered Loudspeaker Management systems. More detailed information is available in the comprehensive PLM Series Operation Manual, which serves as the primary reference source for detailed information on the installation and operation of PLM Series Powered Loudspeaker Management systems.

If you intend to use the device as part of a networked system, or access features via the Lake Controller, please refer to the various supporting documents which can be located via these methods:

- Start > Programs > Lake Controller > Documentation (after installing Lake Controller software)
- On the Installer CD-ROM or the downloaded software installer
- Online at: http://labgruppen.com/index.php/products/documentation/

3. Installation

3.1 Unpacking

Carefully open the shipping carton and check for any damage to the device or the supplied accessories. Every Lab.gruppen product is tested and inspected before leaving the factory and should arrive in perfect condition. If any damage is discovered, please notify the shipping company immediately. Only the consignee may initiate a claim with the carrier or their insurers for damage incurred during shipping. Save the carton and packing materials for the carrier's inspection.

In addition to the PLM Series device, the shipping carton include the following items:

- PLM Series Quick Start & Field Reference Guide
- AC mains lead (power cable) with Neutrik® powerCON® connector
- Rear brackets for additional rack support (pair) along with associated mounting hardware
- Software Installer and Documentation CD-ROM

Please keep the original carton and associated packaging to facilitate shipping of the device should the need arise.

3.2 Mounting

Airflow for cooling the device is from front panel (intake) to rear panel (exit). Please ensure that no object, such as rack doors or lids are placed at the front or rear of the rack to ensure that airflow is maximized. This device has no top or bottom vents and therefore may be stacked directly on top of each other.

Sufficient space should be available at the front of the rack to accommodate the handles, and at the rear to accommodate connectors and cables; allowance must be made for cable or loom bends within a rack.

3.2.1 Rear Mounting

Two rear support brackets along with associated mounting hardware are included with the PLM, as shown in Figure 3-1; it is recommended that these are used wherever possible. Fit the brackets to the vertical rails at the rear of the rack. Figure 3-2 and Figure 3-3 show the fitting options for fixed and removable installation.

The support brackets are reversible and may be fitted to point either to the front or rear of the rack; the orientation used depends on the rack depth and position of the rear rack rails.

Two mounting methods are possible; note that the method shown in Figure 3-2 additionally provides extra security against unauthorized removal. For situations where rapid removal and replacement is required, the method shown in Figure 3-3 should be used.

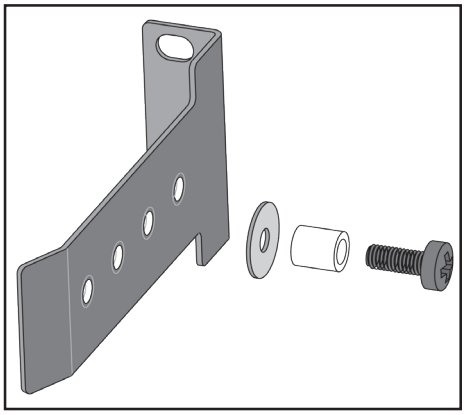

Figure 3-1: Rear Support Bracket and Mounting Hardware

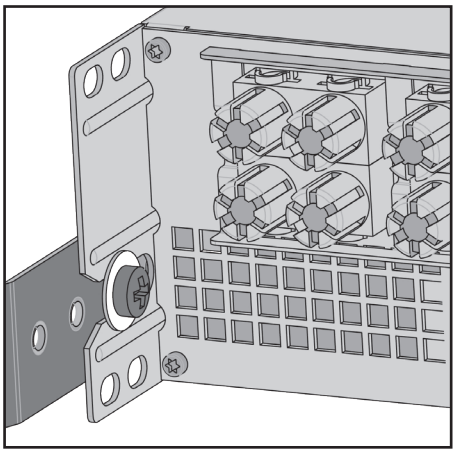

Figure 3-2: Use the Washer for Fixed Installations

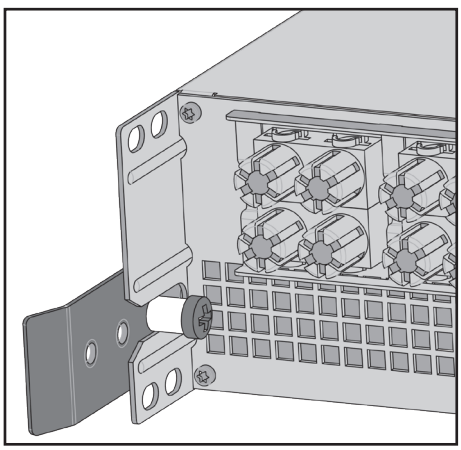

Figure 3-3: Use Tube for Slide-On Installation

3.3 Cooling

3.3.1 Overview

The PLM Series devices use a forced-air cooling system with airflow from front to rear, allowing high continuous power levels without thermal problems. Front-to-rear airflow is preferable as air at the front of a rack is cooler than that at the rear in nearly all situations; never attempt to reverse the airflow. The operation of the PLM's cooling system is dependent on front-to-rear airflow; it will not function effectively with external airflow in the opposite direction.

⚠ Make sure an adequate air supply is provided in front of the PLM, and that the rear of the PLM has sufficient space to allow air to escape. If the PLM is rack-mounted, never operate the unit with any front or rear rack doors or covers in position. It is recommended to keep the ambient temperature around the PLM as cool as possible. An increased temperature can have a significant negative impact on the expected lifetime on the components inside the PLM.

Fit solid blanks (not ventilation blanks) to unused rack spaces to ensure effective air circulation. Leaving gaps in between items of equipment degrades the effectiveness of forced-air cooling.

⚠ If installing one or more PLM Series devices in a rack with other fan-cooled equipment, be sure that all the other equipment also uses front-to-rear airflow for cooling. If this precaution is not observed, there is a risk of overheating, as units with the reverse airflow will be drawing in air which has already been heated by the PLMs.

3.3.2 Temperature Sensing and Protection

The PLM is equipped with a sophisticated temperature sensing system which protects it from any overheating which may occur as a result of inadequate ventilation.

Always ensure the dust filters behind the detachable front panel are clean to ensure maximum possible airflow.

3.4 Operating Voltage

⚠ The label adjacent to the mains (AC) input connector indicates the AC mains voltage for which the device is wired and approved. The PLM 10000Q and PLM 14000 devices are available in separate 115 V and 230 V versions; the PLM 20000Q is only available with a universal power supply operating from 80 to 265 V. Only connect the mains cable (AC cord) to an AC source of the voltage shown on the label.

The PLM uses primary switching, which means the mains power is rectified on the primary side of the transformer. This makes the power supply insensitive to mains frequency variation, and it will operate normally on line frequencies from 45 to 75 Hz.

If the mains plug (AC plug) fitted to the mains cable (AC cord) is not appropriate for your country, it can be removed and a locally-sourced one fitted instead, observing the color coding in the table below:

powerCON Pin	230 V Version	115 V Version
L	Brown	Black
N	Blue	White
⏚	Green/Yellow	Green

Table 3-1: AC Plug Configuration

⚠ If you are not 100% confident of your competence to replace the mains plug (AC plug), the task should be carried out by qualified personnel.

Once a suitable AC power supply is connected, the device can be turned on using the front panel power button. When the device is turned on, the power button LED changes from red (Standby) to green (Active).

NOTE

In-rush current is controlled and limited during the soft-start sequence. This enables multiple PLMs on the same AC mains circuit to be turned on simultaneously.

3.5 Grounding

Analog inputs feature Iso-Float™ ground isolation, a technology which combines the benefits of transformer-coupled isolation with the advantages of clean, direct-coupled inputs.

The audio converters are galvanically isolated, and not connected to the main ground. High-speed transformers and opto-isolators create a barrier between the device and the outside electrical environment.

NOTE

The Iso-Float feature is activated by default, but may be disabled via the Lake Controller software, or via the front panel menu.

Use correctly-shielded balanced audio input connections to minimise hum and interference. Please refer to section 8.2.4 of the PLM Series Operation Manual for further information.

⚠ NEVER disconnect the earth (ground) pin on the mains cable (AC power cord).

4. Product Overview

This chapter provides an overview of key features and functionality. For further information please see chapters 5 to 10 of the PLM Series Operation Manual.

4.1 Front Panel Overview

Figure 4-1: Front Panel Overview

The front panel controls are clustered around a daylight readable LCD ❸, allowing adjustment and monitoring of the majority parameters and meters. The two clusters of controls on either side of the LCD include five dedicated function buttons ❹ ❺ ❻ ❼ ⓬, eight dynamic function buttons with embedded LEDs ❽ ❾ and a rotary data encoder ⓫.

❶ Handles

Two sturdy cast aluminium handles are integrated into the front panel. The handles should be used when carrying the device, and when fitting into or removing from a rack. Ensure that any door or removable rack front cover has sufficient depth to clear the handles.

❷ Dust Filters

Two dust filters are fitted behind metal covers. To remove the covers, loosen the thumbscrews located behind the handles. Once detached, the dust filter elements can be removed for cleaning; please refer to section 9.2 for further information.

NEVER operate this device without the dust filters in place.

❸ Display

The display illuminates when the device is on. The LCD, function buttons, and the rotary encoder provide real-time control and monitoring of most parameters. The LEDs embedded in the function buttons indicate available menu options, provide confirmation of Controller communication, and indicate various faults and warnings.

The brightness and contrast of the display and front panel LEDs can be adjusted via the front panel menu.

Please refer to chapter 7 of the PLM Series Operation Manual for further details.

❹ Standby

PLM Series devices are powered on and to standby using the top-left button, or via the Lake Controller.

❺ Mute Enable

Select MUTE ENABLE to allow the dynamic function buttons to operate as mute controls for the Module inputs and power output channels. The MUTE ENABLE button flashes when the mode is selected; a subsequent press deselects this mode. If left activated, MUTE ENABLE mode will automatically disable two minutes after the last mute action.

❻ Meter

The METER button scrolls through various meter views including the default Home View, Module View, Temperature View and Input View. Pressing METER from Menu Mode returns the screen to Meter Mode with the Home View displayed. Please refer to section 7.5 of the PLM Series Operation Manual for further details.

❼ Menu

After pressing the MENU button, the LCD will display the top level menu. In Menu Mode the dynamic function buttons enable access to various information and functionality. Please refer to section 7.6 of the PLM Series Operation Manual for further details.

❽ Dynamic Function Buttons with LEDs (Left of LCD)

The function of these buttons change according to the currently selected view or menu.

- In Menu Mode they are used for menu navigation and for parameter selection
- In Meter Mode they provide Module input mute/unmute functionality in conjunction MUTE ENABLE

The LED in the top button provides Frame fault and warning indications. The middle two buttons provide Module input mute functionality, mute indication and faults and warning indications relating to the PLM inputs. The bottom button is used only in Menu Mode or to lock the front panel buttons.

Please refer to chapter 7 of the PLM Series Operation Manual for further details.

❾ Dynamic Function Buttons with LEDs (Right of LCD)

The function of these buttons change according to the currently selected view or menu.

- In Menu Mode they are used for menu navigation and for parameter selection
- In Meter Mode they provide PLM output mute/unmute functionality in conjunction MUTE ENABLE

All LEDs provides mute, clip, fault and warning indications for the PLM power outputs channels.

Please refer to chapter 7 of the PLM Series Operation Manual for further details.

❿ Communication LED

The high-intensity white LED illuminates white to indicate that the Module/Frame is selected in the Lake Controller; it flashes white to indicate communication with the Lake Controller.

The brightness of the LCD and communications LED can be adjusted in the Frame page of the Main Menu on the front panel.

⓫ Rotary Encoder

The rotary encoder is used to modify various parameters (e.g. input level) via the menu. When a menu item is selected that permits adjustment of parameter values, the ring around the rotary encoder illuminates. In Home View the encoder can be used to scroll through the Meter Views.

⓬ Exit

The EXIT button is used primarily while navigating the menu system in Menu Mode; pressing EXIT will return the menu up one level. In Meter Mode, pressing EXIT returns the metering display to the default Home View.

4.2 Back Panel Overview

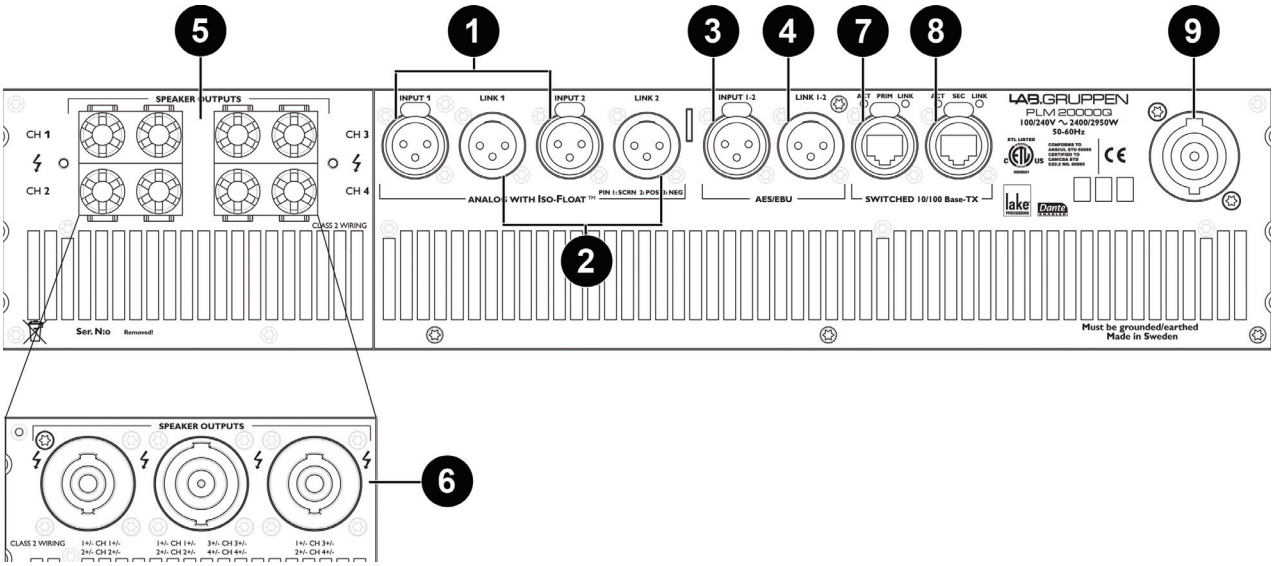

Figure 4-2: Back Panel Layout Options for a 4-channel PLM

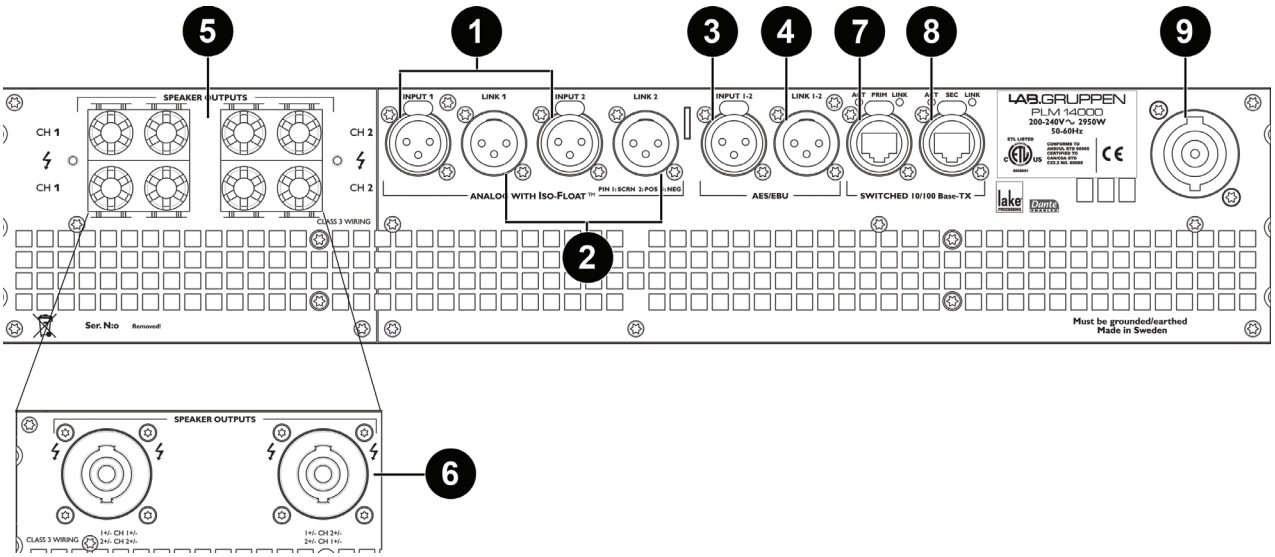

Figure 4-3: Back Panel Layout Options for a 2-channel PLM

4.2.1 Input and Link Connectors

❶ Analog Inputs

Analog inputs are available on two standard XLR3F latching connectors. The inputs are electronically balanced and feature Lake Iso-Float circuitry. The impedance is 20 kohms, and the inputs can accept a maximum input level of +26 dBu.

❷ Analog Links

Two latching XLR3M connectors are fitted adjacent to the analog input connectors. These are paralleled to the input connectors to provide an unprocessed analog loop-through to feed additional PLM Series units, or other equipment.

❸ AES3 Inputs

A latching XLR3F connector is provided which accepts an AES3 digital audio signal. Input impedance is 110 ohms, please ensure that 110 ohm digital audio cables are used; standard XLR microphone cables are rarely suitable for reliable digital audio transmission.

AES3 is a stereo digital format, and therefore both PLM inputs are fed via a single connector. Selection of the analog or digital inputs is made via the front panel display or control software.

❹ AES3 Link

A latching XLR3M connector is fitted adjacent to the AES3 input connector. This is paralleled to the input connector to provide an unprocessed AES3 loop-thru to feed further PLMs, or other equipment. An AES3 110 ohm termination load is enabled by default when the PLM is the last unit connected within an AES3 daisy-chained system. The termination may be disabled, if desired, via the front panel menu and within the Lake Controller software.

4.2.2 Output Connectors

The PLM is available with a choice of connectors for power outputs: binding posts or Neutrik speakON®. Both connection methods allow for Bridge Mode operation, which is activated from the Lake Controller software. Please refer to the Lake Controller Operation Manual and section 8.1.1 of the PLM Operation Manual for further information on Bridge Mode.

❺ Binding Posts

In this version, the power outputs for loudspeaker connection are available on four separate pairs of fully enclosed binding posts. Bridge Mode can be enabled via the Lake Controller software, please refer to the Lake Controller Operation Manual for further information.

Channel configuration for the binding posts is dependent on the PLM model, please refer to section 8.1.3 of the PLM Operation Manual for standard and Bridge Mode wiring.

❻ speakON Connectors

The speakON connector configuration differs on 2-channel and 4-channel PLM models.

On 4-channel models, the power outputs are simultaneously available on a single 8-pole speakON connector, and on two 4-pole speakON connectors. The two 4-pole connectors carry the outputs of channels 1 & 2 and 3 & 4 respectively.

On 2-channel PLM models the two power output channels are available simultaneously on two 4-pole speakON connectors. Both connectors carry both channels. The second connector offers the channels in reverse order.

Bridge Mode can be enabled via the Lake Controller software, please refer to the Lake Controller Operation Manual and to section 8.1.2 of the PLM Operation Manual for further details on standard and Bridge Mode wiring for speakON connectors.

4.2.3 Ethernet and Power Connectors

❼ Primary Network Connector

The primary Neutrik RJ45 etherCON® connection provides integration into an Ethernet control network which may include other Lake Processors and the Lake Controller software. Network connection permits full control of all functions along with real-time metering from a remote position. This device supports the Dante audio networking protocol, which allows transmission of multichannel, high-definition digital audio over the same Ethernet connection.

Use the primary connector when using a star network topology, consisting of individual Cat-5e connections between the devices and an Ethernet switch. Alternatively this connection can be used to daisy chain directly to another Lake Processor. The daisy chain topology should not be used with Dante.

For a technical reference of the Ethernet Port, please refer to section 8.4 of the PLM Series Operation Manual. Additional information is also available in the Lake Network Configuration Guide.

The Ethernet ports operate at the Ethernet data rate of 100 Mbps, and allow straight or crossed network cables. Two LEDs above each port indicate valid network connection (LINK) and network activity (ACT).

❽ Secondary Connector

The secondary network connector can be used to daisy-chain multiple LM & PLM Series and legacy Dolby and Lake devices. Alternatively, a Dante dual-network topology can be created by connecting all secondary network connectors to a separate Ethernet switch, ensuring full redundancy in the event of a network component failure.

Additional processor configuration is required for a dual redundant network setup. See the Lake Controller Operation Manual for further details.

For a technical reference of the Ethernet Port, please refer to section 8.4 of the PLM Series Operation Manual. Additional information is also available in the Lake Network Configuration Guide.

When connecting multiple devices to an Ethernet network, care must be taken NOT to create a closed loop which causes network malfunction.

❾ Mains Power Connector

The mains power AC input is via a Neutrik powerCON connector, rated at 32 A.

The power supply must be connected to AC mains using a power cable with a correctly wired plug for the country of operation.

5. Signal Flow and Lake Processing

5.1 Signal Flow

The figures below depict the audio signal flow for a PLM Series device. It is worth noting that this sophisticated device provides seven points in the signal chain where the signal level can be adjusted, muted or disconnected. The blue sections represent Frame data, and the red sections represent Module data - please refer to the Lake Controller Operation Manual for further information.

Important information regarding correct setting of the gain structure can be found in section 10.3 of the PLM Series Operation Manual.

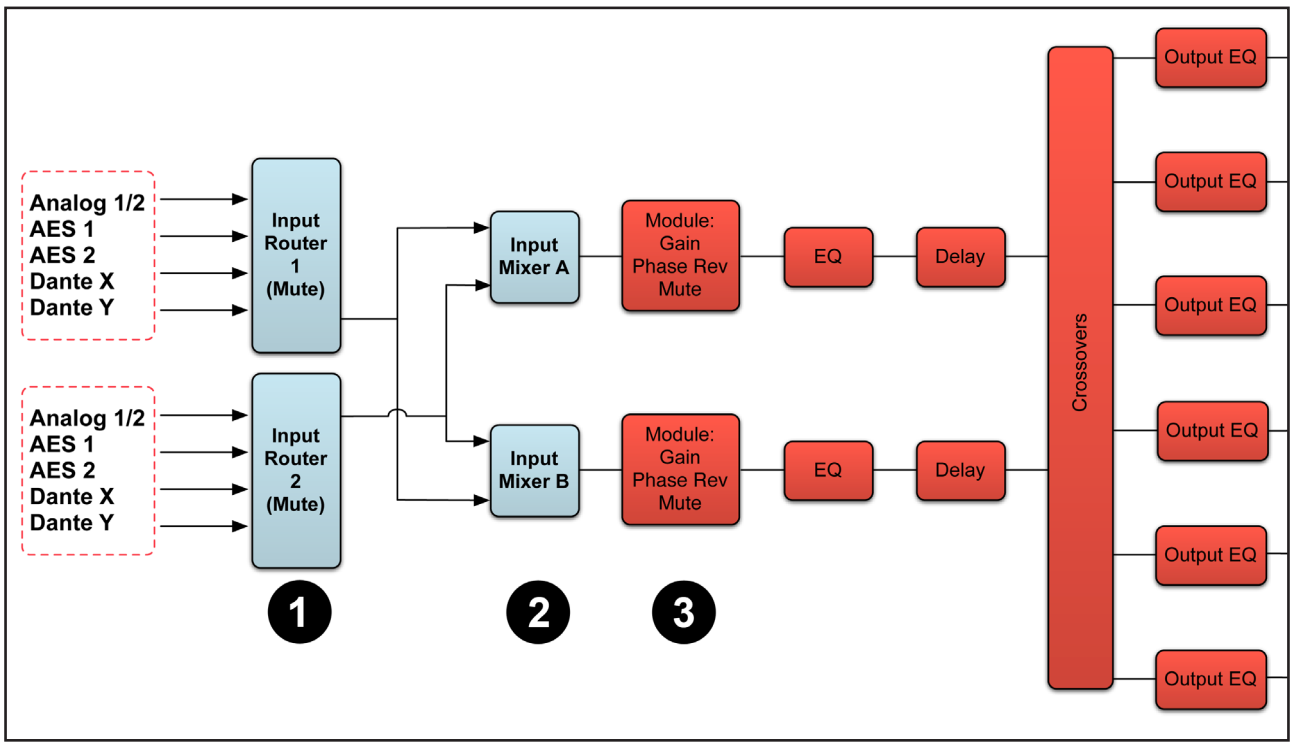

Figure 5-1: Signal Flow Diagram (PLM Series Part 1)

The numbers below correspond the points identified in Figure 5-1 and Figure 5-2.

❶ Input Router Stage - Input selection and MUTE

❷ Input Mixer Stage - Router ON/OFF connection to mixer and gain settings

❸ Module Input Stage - Mute (N/A for LM Series Mesa Mode) and gain settings

❹ Module Output Stage - Mute and gain settings

❺ Output Router Stage - Output ON/OFF routing connections

❻ Attenuation Stage - Power output channel mute and attenuation settings

❼ Amp Gain Stage - Amplifier gain control

If the required audio signal is not passing correctly, verify the connection, mute and gain settings at all seven stages.

5.1.1 Power Output Section: Limiting and Sensitivity

The Current Peak Limiter (CPL) dynamically limits the drive to the power stage based on three parameters: sensed output current level, feedback from the output stage, and sensed voltage clip from the ISVPL. This ensures that power output is maintained within the design limits of the PLM.

The adjustable Inter-Sample Voltage Peak Limiter (ISVPL) sets the PLM's maximum output voltage and therefore also the maximum output power. The ISVPL setting is made via MENU > MODULE > LIMITERS > ISVPL, and can also be set from the Lake Controller software.

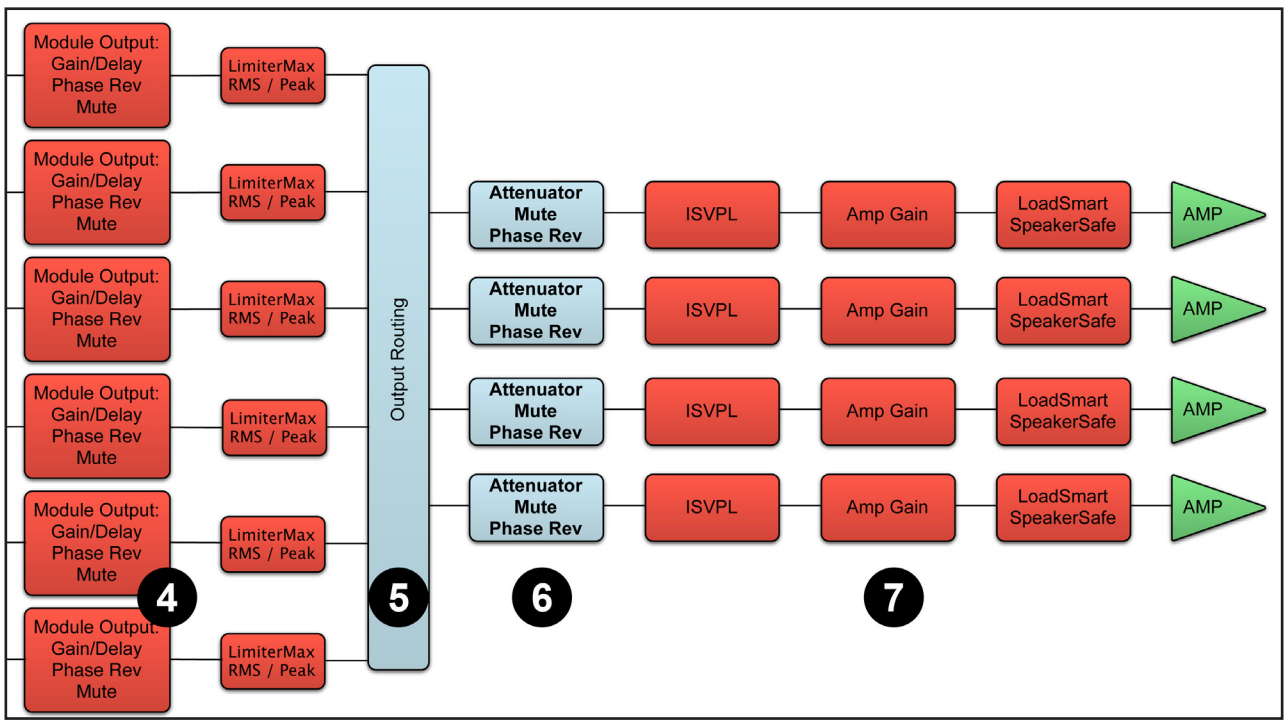

Figure 5-2: Signal Flow Diagram (4-channel PLM Part 2)

The sophisticated output section monitors faults and generates warnings when appropriate; warnings are displayed on the front panel of the PLM and also sent as messages over the control network. In the rare event that maximum ratings are significantly exceeded, the PLM will shut down until the condition has been rectified or the incorrect setting has been readjusted. Sensing circuits also transmit local output power stage temperature, processor card temperature, and PSU temperature to the appropriate protection circuits. Please refer to section 5.3 on page 17 further details.

Table 5-1 lists PLM Series analog input sensitivity in dBu and Vrms for various Amp Gain settings and maximum/minimum ISVPL settings, assuming an analog input headroom of 26 dBu.

INPUT SENSITIVITY								
ISVPL SETTING	194 V		193 V		153 V		17.8 V	
GAIN (dB)	dBu	Vrms	dBu	Vrms	dBu	Vrms	dBu	Vrms
+44	+1.0	0.87	+0.9	0.86	-1.1	0.68	-19.8	0,08
+41	+4.0	1.22	+3.9	1.22	+1.9	0.96	-16.8	0.11
+38	+7.0	1.73	+6.9	1.72	+4.9	1.36	-13.8	0.16
+35	+10.0	2.44	+9.9	2.43	+7.9	1.92	-10.8	0.22
+32	+13.0	3.45	+12.9	3.43	+10.9	2.71	-7.8	0.32
+29	+16.0	4.87	+15.9	4.84	+13.9	3.84	-4.8	0.45
+26	+19.0	6.88	+18.9	6.84	+16.9	5.42	-1.8	0.63
+22	+23.0	10.90	+22.9	10.84	+20.9	8.59	+2.2	1.00

Table 5-1: Analog Input Sensitivity in dBu and Vrms

5.2 Lake Processing and Control

As outlined in section 2.2.3, this device integrates seamlessly into the Lake Processing environment, providing all features, functionality and connectivity associated with all Lake Processors. The internal Lake Processing includes programmable crossovers, EQ, dynamics and other functions, and can be fully controlled via the supplied Lake Controller software. Additionally, many functions can be controlled or accessed directly via the front panel.

The Lake Controller Operation Manual and Lake Network Configuration Guide are supplied on the accompanying CD-ROM and additional documentation is available from the Start Menu after software installation.

Visit http://labgruppen.com to download the latest software, firmware and documentation for your devices.

5.3 Modules and Frames

5.3.1 Overview

A Frame represents one physical Lake Processor (e.g. PLM 10000Q). A maximum of two Modules are contained within each Frame; these are referred to as Module A and Module B. The number of Modules shown in a given Frame is dependent upon the signal processing configuration of that Frame.

Each Module can be configured as a Classic Crossover (Bessel, Butterworth, Linkwitz-Riley), as a Linear Phase Crossover, or as multiple full bandwidth Auxiliary Outputs. The default configuration for the PLM is 2 x 2-Auxiliary Output Modules, providing a total of four Module outputs.

Please refer to the Lake Controller Operation Manual for further information.

5.3.2 LoadLibrary™ and Fingerprints

In addition to the standard loudspeaker presets (Module files), the Lake Controller also includes a set of enhanced Module files specifically for use with the PLM Series.

These supplementary PLM Module files, known as the LoadLibrary incorporate both Lake DSP parameters along with PLM specific data; LoadLibrary Module files include parameter settings for the PLM's Amplifier Gain and ISVPL limiter. Additionally, LoadLibrary loudspeaker types may also include data relating to the electrical characteristics of a particular loudspeaker.

Electrical characteristic data is used to enable load verification (LoadSmart) and monitoring facilities (SpeakerSafe) to be performed on the PLM. This data set is termed a Fingerprint. When a PLM-specific loudspeaker type is loaded, its Fingerprint load characteristics are included. These load characteristics are stored in a file with a ".mdl" suffix and are loaded simultaneously with the module file.

LoadLibrary Modules and standard Module files are cross-compatible, although when a LoadLibrary Module is loaded into a legacy Lake product the extra data within it is ignored.

5.3.3 Super Modules

Super Modules allow control of multiple Modules of the same type, distributed across multiple Frames, as a single entity within the Lake Controller software. A change made in the Super Module is replicated across all assigned Modules, resulting in improved efficiency in system configuration and a reduction of on-screen icons within the Lake Controller software.

The key benefit of this feature is the ability to connect and control crossovers, levels and EQ across multiple hardware devices simultaneously from the Lake Controller. For example, one device may be driving sub and low-frequency speakers, while another device controls mid-range and hi-frequency drivers. Using a single adjustment the crossover points between the two devices can be changed simultaneously.

Please refer to the Lake Controller Operation Manual for further information regarding Super Modules.

5.4 Loudspeaker Processor Overview

The Lake Processing system within PLM Series devices may be configured with up to two processing Modules containing a total of up to six processing Module outputs, although the number of power outputs will be either two or four depending on the PLM model being used. To make use of the extra processing channels, multiple hardware devices may be connected together using the Super Module feature as summarized in section 5.3.3.

Each set of processing elements is referred to as a Module and can be configured as crossovers, full-bandwidth auxiliary outputs, or a combination of the two. The relationship between inputs and outputs is defined via the Lake Controller or via the front panel Input Config Menu.

The Lake Processing system provides two distinct categories of crossovers:

- Infinite Impulse Response filters (IIR) such as the classic Bessel, Butterworth or Linkwitz-Riley types; these are available with slopes ranging from 6 dB/octave to 48 dB/octave.
- Finite Impulse Response filters (FIR) providing zero phase shift with steep transition slopes at the crossover frequencies. These are also referred to as Linear Phase Crossovers.

Further details on these types of crossovers and information on configuring various module types can be found in the Lake Controller Operation Manual.

5.5 Files and Presets

The Lake system provides various methods for storing and recalling Module, Frame, or system-wide data. An overview is provided below; for further information please refer to the Lake Controller Operation Manual.

5.5.1 Module, System and Sub-System Configuration Files

Module, System and Sub-System Configuration files are stored on the Lake Controller PC, and data is passed across the network when recalling or storing these type of files.

- A Module file is the smallest set of data that can be stored and recalled; it contains crossover, gain, delay, and limiter information for an individual loudspeaker (i.e. the data shown in red in the signal flow diagrams in section 5.1). A Module file may be recalled into other Lake devices. It is not possible to store a Module File directly on the hardware device.
- A System or Sub-System Configuration File contains a set of Module file information in addition to Frame related information such Group data and I/O configuration (i.e. the data shown in blue in the signal flow diagrams in section 5.1).

5.5.2 Frame and System Presets

This device allows the complete processor configuration to be stored as a Frame Preset on the hardware unit itself. Presets can be recalled via the front panel (please refer to section 7.11.7) or via the Lake Controller software (please refer to the Lake Controller Operation Manual). Presets can be stored into the device using the Lake Controller or the LM Series Preset Manager utility.

A maximum of 100 Frame Presets can be stored on this device. The data within a Frame Preset includes the configurations of both Modules in the Frame, including all levels, crossover, EQ, input mixer, output routing, and all other Module, Frame and Group parameters. As Frame Presets are stored in the device, complete processor configurations may be recalled without the need to connect the device to a PC.

Using the System Presets function in the Lake Controller, entire system configurations can be stored and recalled across a network of LM & PLM Series devices, Dolby Lake Processors, Mesa Quad EQ and the Contour Pro 26. This enables fast retrieval and switching of entire system configurations as minimal data is being sent between the Controller and Processors.

6. Quick Start Tutorial

6.1 Introduction

This section describes installation of the Lake Controller software, input and output connections, basic functionality, and setup instructions. The information provides a basic level of understanding of the system architecture along with configuration instructions for a basic system application.

The tutorial in section 6.4 provides a step-by-step example for configuring this device for use with a generic professional sound system. Please refer to the documentation listed in section 2.3, which provides detailed information on all features and functionality.

6.2 Lake Processing and Control

PLM Series products contain an integrated Lake loudspeaker management system, providing crossovers, EQ, dynamics and other functions. Primary control is via the supplied Lake Controller software, although many functions can be accessed via the front panel interface.

The Lake Controller software allows all parameters to be configured, controlled and monitored; please refer to the Lake Controller Operation Manual for further details. The Lake Network Configuration Guide provides information regarding connection of one or more Lake Processors to a PC via an Ethernet network.

6.3 Installing the Lake Controller Software

6.3.1 Overview

The supplied CD-ROM contains the Lake Controller software package. This should be installed on any PC/s that will be used to control and monitor the Lake Processor network. In a situation where multiple networked Lake Processors are involved, this will generally be a Tablet PC.

The minimum recommended computer specifications are:

- 1 GHz or faster
- 512 MB RAM or greater
- 128 MB video RAM or greater
- Windows XP, Windows Vista or Windows 7
- DirectX® 8.1 or later
- 100 Base-T wired Ethernet adapter and/or 802.11 wireless Ethernet adapter

When using large Lake processor systems it is recommended that a computer exceeding the minimum specifications is used. If you are unsure about installing PC software, please contact an IT specialist.

6.3.2 Software Installation

The Lake Controller software is installed by inserting the CD in the computer's CD drive and allowing the auto-setup routine to run. Select INSTALL then LAKE CONTROLLER SOFTWARE on the software installation screen that is displayed. For most installations, the suggested default installation paths can be accepted.

If you are using a computer without a CD/DVD drive, the latest software can be downloaded from http://labgruppen.com/index.php/support/software_firmware/ after completing an online registration form. It is recommended that all users verify they are using the latest version of software.

Once the software is installed, the application is launched by double-tapping the LAKE icon on the Windows desktop. Please refer to the Lake Controller Operation Manual for further details on software installation and PC configuration.

6.3.3 Software and Firmware Updates

Regular software and firmware updates are available for the Lake Controller software and PLM Series devices. Please check for updates regularly to ensure you have the latest features and improvements.

Registered users will receive email notification of updates as they become available. The latest updates are also available from http://www.labgruppen.com/index.php/support/software_firmware.

Please refer to the Lake Controller Operation Manual for further details on the firmware upgrade procedure.

6.3.4 Ethernet Configuration

This device provides control, monitoring and digital audio functionality via an Ethernet network.

For further information on the setup and configuration of an Ethernet network, please refer to the Lake Controller Operation Manual and the Lake Network Configuration Guide.

6.4 PLM Series Configuration Tutorial

This tutorial provides a step-by-step guide for configuration of a typical professional loudspeaker system and provides an overview of the basic features and operation of PLM Series devices. This tutorial uses the Lake Controller software for configuration, although many steps are also available via the front panel interface.

This tutorial describes how to configure 4-channel PLM for use with a 3-way loudspeaker system (with separate HF, MF and LF drivers), plus a separate Auxiliary output for feeding a subwoofer. It assumes the use of an analog mixing desk, and that a dedicated subwoofer output is generated on the mixing console itself using an auxiliary output send.

The example uses a hypothetical loudspeaker to illustrate the principles involved. No speaker–specific data or LoadLibrary Fingerprint is included in the crossover configuration. Please also note that, for the purposes of this tutorial, it is possible to connect small full-range cabinets ensuring close attention is given to steps 31 to 40 to avoid excessive power levels that could damage the loudspeakers.

The following tutorial assumes use of a Tablet PC and therefore the term TAP rather than CLICK is used for activating commands.

1. Connect the loudspeakers to the four power output channels:
   - Channel 1 – Low Frequency Driver
   - Channel 2 – Mid Range Driver
   - Channel 3 – High Frequency Driver
   - Channel 4 – Subwoofer
2. Connect the main output of the mixing console (left or right channel as appropriate) to Analog Input 1 of the PLM. Connect the sub output from the mixing console to Analog Input 2.
3. Ensure the volume is turned down for both the main and sub send on the console and that no audio is passing through the system.
4. Ensure the PLM is connected to a PC running the Lake Controller software.
5. After ensuring that no audio is being output from the mixing console, power on the PLM.
6. On the Tablet PC, launch the Lake Controller software application. Select the appropriate network adapter if more than one is enabled, and tap NO to the dialog asking whether to load the previous configuration.
7. Tap MODULES to access the Module Menu and scroll bar.

8. On the Module scroll bar, the PLM is represented with a frame containing two discs. These are labeled A and B and represent the two Lake processing modules.

9. Tap the frame to select it, then tap again in the MAIN area of the screen to place both modules of the frame in the current system configuration. The Lake Controller uploads settings from the PLM.

10. Tap the icon for Module A; its border will turn yellow to confirm selection and an LED on the front panel of the associated device will also be illuminated.

11. Tap the MODULE STORE/RECALL button on the Modules Menu; the menu will change to show additional options.

12. Double-tap the Default Modules folder then double-tap the Contour Classic Crossovers folder. A set of loudspeaker symbols will be displayed.

13. Tap CL3w+1a, and then tap the RECALL button. This configures the DSP for the Module A as a 3-way crossover, plus a separate auxiliary channel.

14. Tap YES when asked to confirm that all data will be overwritten; tap 2-Way on the subsequent dialog regarding Module B configuration (not be used during this tutorial).

15. Tap STORE/RECALL EXIT to return to the Modules Menu.

16. Ensuring Module A is still selected (yellow border), tap I/O CONFIG.

17. The top-right of the I/O CONFIG screen displays a block diagram of Module A, including an input gain mixer summary. Tap on the blue INPUT 1 block to open the Input Mixer.

18. The Input Mixer shows the individual input levels and connectivity status, along with a meter on the right which displays the combined mixer output signal level. Verify Input 1 fader is set to 0.00 dB and turn all other inputs off.

19. Tap the blue return arrow button at the bottom right of the screen to return to I/O CONFIG.

20. Locate the small square block labeled POST EQ towards the bottom of Module A's block diagram. A setting of POST EQ indicates that the Auxiliary output channel is fed from same audio source and the 3-way crossover.

21. Tap the POST EQ button so it changes to read INPUT MIX.

22. Tap any of the blue INPUT MIXER summary blocks associated with the Auxiliary Output channel to open the separate Aux Input Mixer.

23. Ensure INPUT 2 is turned on and set to 0.00 dB, and that all other inputs are OFF.

24. Tap the bottom-right return button to close the Aux Input Mixer.

25. As Module B's processing is not required for this configuration, open Module B's input mixer, and turn all inputs OFF. Press the return key/button to navigate back to I/O CONFIG.

26. Tap any of the four magnifying glass icons on the right-side of Module A's block diagram to open the Output Configuration screen.

27. Verify that the Output Configuration is routed as shown in Figure 6-1 below where Source = Module Outputs and Destination = Analog Outputs.

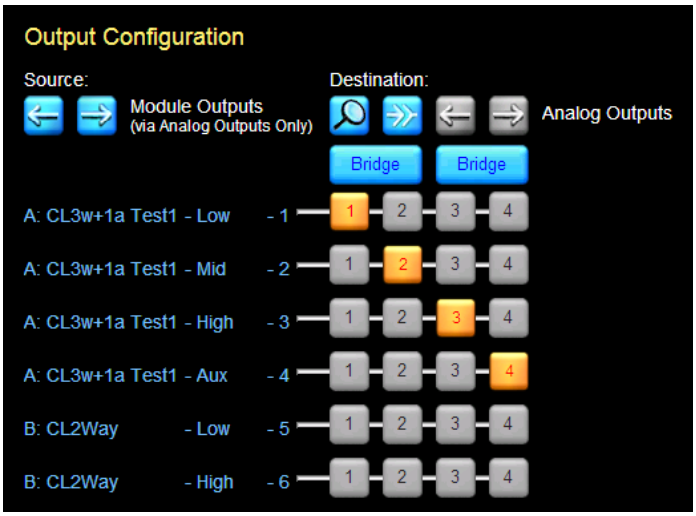

Figure 6-1: Classic 3+1 Analog Output Configuration

28. If the output assignments are not as shown, tap the Clear All Assignments button (split arrows); tap YES to the warning dialog box; then tap the numeric buttons correctly route the audio to the appropriate physical output/s.

29. Tap the return key to close this screen and return to I/O CONFIG.

30. The following settings on the left-side of the I/O CONFIG screen should be correct by default; if they are incorrect, please refer to the Lake Controller Operation Manual for further details.

- DIGITAL CLOCK:
  Internal – 96 kHz
- INPUT CONFIGURATION:
  #1: Auto Type: Analog Offset/Headroom: 26 dBu
  #2: Auto Type: Analog Offset/Headroom: 26 dBu
- DANTE CONFIGURATION:
  Dante Disabled
- ANALOG ISO-FLOAT & AES TERMINATION:
  Inputs 1-2: Floating AES: Terminated

31. Tap EVENTS & CONTROL to access various amplifier specific information and options, including four amplifier attenuation controls on the STATUS tab. As a precaution, drag all four faders to the minimum position.

32. Tap the bottom-right return button to return to I/O CONFIG.

33. Tap the INPUT GAIN block on the interactive block diagram for Module A. The LEVELS screen displaying the gain parameters for Module A will be displayed. This screen can also be accessed by returning to HOME and tapping the Module icon.

34. There are five gain faders displayed (1 Module Input, 4 Module Outputs). Set the values by dragging the fader, or by tapping the blue highlighted values at the top of the screen:

    - INPUT: -0.00 dB
    - LOW-1: -3.00 dB
    - MID-2: -6.00 dB
    - HIGH-3: -12.00 dB
    - AUX-4: 0.00 dB

35. Tap the EQ tab at the top-left of the screen, then tap the XOVER tab. This screen shows the frequency split settings for the 3-way crossover and can be adjusted according to manufacturer specifications or by measurement and manual tuning as required. Please refer to the Lake Controller Operation Manual for detailed information on the XOVER screen.

36. Tap the AUX-4 tab to show the HPF/LPF and EQ settings for the Subwoofer channel. Please refer to the Lake Controller Operation Manual for detailed information on the AUX screen.

37. Navigate to the LEVELS page by tapping the LEVELS tab at the top left of the screen.

38. Unmute the Module Input by tapping the red MUTED button; the button turns blue and reads UNMUTED.

39. Start playback of audio through the mixing console and turn up the volume of the MAIN and SUB-WOOFER channels from the mixing console.

40. From I/O CONFIG, tap EVENTS & CONTROL and navigate to the STATUS tab. Slowly increase the attenuation faders to turn up the amplifier channels. If the PLM is connected to loudspeaker, audio should now be heard.

41. Use the powerful XOVER, AUX, PEQ and GEQ screens to tune your loudspeaker as required. Please refer to the Lake Controller Operation Manual for detailed information on these features.

6.5 Gain Structure

The PLM Series architecture provides gain adjustments at various points in the signal path and therefore, various places for muting and level adjustment. Each mute or gain adjustment point serves a different purpose.

Detailed information on signal flow and gain structure is available in the PLM Series Operation Manual. The signal flow diagrams show in chapter 5 are useful signal path references, and the following sections describe the various adjustment points, all of which are available via the Lake Controller software.

6.5.1 Input Headroom (Analog Inputs Only)

Input Headroom should be set to 12 dBu if the source can be limited to 12 dBu; otherwise it should be set to 26 dBu. This setting does not affect the other gain stages, or the overall noise floor; it allows control of the appropriate headroom at the input stage only.

6.5.2 Input Mixer

Input Mixer gains can remain at 0.00 dB for most configurations; if only one input channel is used per Module, the other can be set to -INF.

6.5.3 Module Input Gain

Input Gain is used to adjust the level between different speaker cabinets in the system. This gain can remain at 0.00 dB unless a lower level is required for the cabinet/s driven by this Module.

Module Input Gain is not applicable for LM Series devices configured in Mesa Mode.

6.5.4 Module Output Gain (Levels)

Factory and User Gain are provided for each Module output. These two stages provide a level of security and control for the system designer (Factory) and a further level of adjustment for the user (User), both of which combine to balance the level between frequency bands in a multi-way crossover.

Generally, output gain values are configured within a Module / loudspeaker preset file and should not need to be adjusted further.

6.5.5 Attenuator

An attenuator gain adjustment is provided for each power output channel in the PLM. This control replaces the traditional volume control found on conventional amplifiers and should typically be left at 0 dB during use.

6.5.6 Amp Gain

The Amp Gain corresponds to the gain adjustment in a conventional separate loudspeaker processor and amplifier system. When using a pre-defined Module loudspeaker preset file, the Amp Gain settings will normally remain as defined in the file. The limiter and output gain settings of the Module were configured with this gain setting and will not be automatically compensated if changes are made. This configuration scheme, though unusual, allows for compatibility with legacy Dolby / Lake products.

6.6 Gain / Level Optimization

6.6.1 Maximize Volume Capability

To maximize the volume capability of the device, ensure there is sufficient headroom in the signal path to avoid clipping before the limiters engage. It must be possible to achieve enough gain through the device to engage the limiters and realize a high average SPL. As an optimal setting, allow for a headroom of 10 dB or more for all channels; the simplest way to accomplish this is to increase the Module input gain.

6.6.2 Minimize Noise

To help provide the best volume to noise ratio, use an AES or Dante digital input signal wherever possible. If using analog inputs, ensure that unused or unnecessarily high headroom is not introduced at the input to the device. If full or high average power is not required, the Module input gain may be reduced.

7. Technical Specifications

Model	PLM 20000Q	PLM 14000	PLM 10000Q
Number of input channels	2	2	2
Number of output channels	4	2	4
Peak total output all channels driven	20000 W	14000 W	10800 W
Max. Peak output voltage per channel	194 V	193 V	153 V
Max. output current per channel	67 A peak	90 A peak	49 A peak
Max. Output Power			
16 ohms per ch. (all ch.'s driven)	1150 W	1150 W	660 W
8 ohms per ch. (all ch.'s driven)	2300 W	2300 W	1300 W
4 ohms per ch. (all ch.'s driven) [1]	4400 W	4300 W	2300 W
2 ohms per ch. (all ch.'s driven) [1]	4800 W	7000 W	2350 W
All channels driven into optimal impedance interval	>5000 W into 2.2 - 3.3 ohms	>7000 W into 1.8 - 2.1 ohms	>2700 W into 2.4 - 3.2 ohms
8 ohms bridged per ch.	8800 W	8600 W	4600 W
4 ohms bridged per ch.	9600 W	14000 W	4700 W
Bridged into optimal impedance interval	>10000 W into 4.4 – 6.6 ohms	>14000 W into 3.6 – 4.2 ohm	>5400 W into 4.8 – 6.2 ohms
Audio Performance			
THD + N 20 Hz - 20 kHz for 1 W	<0.05%		
THD + N at 1 kHz and 1 dB below clipping	<0.04%		
Dynamic range with digital inputs (for all supported sample rates)	>114 dB	>114 dB	>116 dB
Dynamic range with analog inputs	>110 dB	>110 dB	>112 dB
Frequency response (1 W into 8 ohms, 20 Hz - 20 kHz)	+ /-0.05 dB		
Common Mode Rejection (CMR)	>74 dB, 20 Hz to 20 kHz		
Internal sample rate	96 kHz		
Internal data path	32 bit floating point		
Product propagation delay, best case (96 kHz AES)	1.61 ms		
Product propagation delay, analog input	1.68 ms		
Sample Rate Converters			
THD + Noise	0.00003 %, 20 Hz - 20 kHz, unweighted		
Analog to Digital inputs			
Inputs	2 inputs x 2 link		
Input sensitivity settings	+12 or +26 dBu		
THD + Noise	0.00022 %, typical at 1 kHz unweighted at +26 dBu headroom setting 0.00033 %, typical at 20 Hz and 20 kHz unweighted at +26 dBu headroom setting		
AES / EBU inputs			
Inputs	2 inputs x 2 link		
Supported resolutions	≤ 24 bit		
Supported sample rates	44.1, 48, 88.2, 96, 176.4, 192 kHz		
Dante Audio Network			
Inputs and outputs	2 inputs, 2 outputs		
Supported sample rates	48, 96 kHz		
Supports redundant paths	Yes		
Flexible topology	Yes		
Network latency	0.8, 1.3 and 4 ms		
Device presets			
Local memory locations for the settings of the product	100		
Limiters			
Adjustable Inter-Sample Voltage Peak Limiter (ISVPL)	17.8 - 194 V, step size 0.1 V	17.8 - 193 V, step size 0.1 V	17.8 - 153 V, step size 0.1 V
Current Peak Limiter < 300 ms	67 A peak	90 A peak	49 A peak
Current Average Limiter (CAL) > 300 ms	33 Arms	44 Arms	25 Arms
LimiterMax (rms and peak limiters)			
– MaxRMS (rms voltage limiter)	Yes		
– MaxPeak (peak voltage limiter)	Yes		
Gain			
Amplifier gain	22 - 44 dB, step size 0.1 dB		
Output attenuator	-Inf to 0 dB, step size 0.25 dB		
Rear-panel interface			
AES / EBU / I/O (input + link)	2 x 3-pin XLR		
Analog, 2-channel I/O (input + link)	4 x 3-pin XLR, electronically balanced		
Output connectors	Neutrik speakON (1 x NLT8, 2 x NLT4) or 4 Binding Posts (pairs)	Neutrik speakON (2 x NLT4) or 4 Binding Posts (pairs)	Neutrik speakON (1 x NLT8, 2 x NLT4) or 4 Binding Posts (pairs)
Auto 10/100, Auto Uplink	2 x RJ45 etherCON		
Control and monitoring interface	Via Ethernet for Lake Controller software, or DLM (the 3rd Party Protocol)		
Detachable mains cord	Neutrik powerCON 32 A		
Cooling	Three fans front-to-rear airflow, temperature controlled speed	Two fans front-to-rear airflow, temperature controlled speed	Two fans front-to-rear airflow, temperature controlled speed
Front-panel user interface			
Display	2.5 inch, daylight readable LCD		
Fault/Warning/Limit/Clip indicators	RGB LEDs and detailed fault description on display		
Mute and soft function buttons	8 provided		
Standby Power button	On/Standby		
Mute Enable button	Enables muting of outputs and inputs via soft-button keypad		
Meter button	Toggles through meter views		
Menu button	Provides a menu driven interface for full function front panel control		
Rotary Encoder	Yes		
Exit button	Provides a "back" function		
Power			
Operating voltage (45 - 66 Hz)	Universal power supply 70 - 265 V	140-265 V / 70-135 V [2]	140-265 V / 70-135 V [2]
Soft start / Inrush Current Draw	Yes / max. 8 A	Yes / max. 5 A	Yes / max. 5 A
Power Average Limiter (PAL)	Yes	Yes	Yes
Power Factor Correction (PFC)	Yes	No	No
Breaker Emulation Limiter (BEL), software controlled 5 - 32 A	Yes, selectable breaker profile	No	No
Under-Voltage Limiter (UVL)	Yes	No	No
Dimensions			
Rack rail to rear panel	W: 483 mm (19"), H:88 mm (2 U), D: 424 mm (16.7")	W: 483 mm (19"), H: 88 mm (2 U), D: 386 mm (15.2")	W: 483 mm (19"), H:88 mm (2 U), D: 386 mm (15.2")
Overall depth including handles and rear support	498 mm (19.6")	460 mm (18.1")	460 mm (18.1")
Weight	17 kg (37 lbs.)	13.5 kg (30 lbs.)	13.5 kg (30 lbs.)
Finish	Black painted steel chassis with black painted steel / aluminum front		
Approvals	CE, ANSI/UL 60065 (ETL), CSA C22.2 NO. 60065, FCC		

Note 1): Asymmetrical loading of the outputs will yield even higher ratings. If one (or two) channel(s) has reduced power requirements, then the voltage drop from the power supply will be reduced, resulting in higher power availability for the other channel(s).
Note 2): Separate 230 V or 115 V versions available. Not selectable on the product.

All specifications are subject to change without notice.

8. Warranty and Support

8.1 General

This product is manufactured by Lab.gruppen, and it is warranted to be free from any defects caused by components or factory workmanship, under normal use and service, for a period of three (3) years from date of purchase from an authorized Lake dealer.

If the product fails to perform as specified during the warranty period, Lab.gruppen will undertake to repair, or at its option, replace this product at no charge to its owner, provided the unit is returned undamaged, shipping prepaid, to an authorized service facility or to the factory.

This warranty shall be null and void if the product is subjected to: repair work or alteration by a person other than those authorized by us; mechanical damage including shipping accidents; war, civil insurrection, misuse, abuse, operation with incorrect AC voltage; incorrect connections or accessories; operation with faulty associated equipment; or exposure to inclement weather conditions. Damage due to normal wear and tear is not covered by the warranty. Units on which the serial number has been removed or defaced will not be eligible for warranty service.

Lab.gruppen shall not be responsible for any incidental or consequential damages. Lab.gruppen's responsibility is limited to the product itself. Lab.gruppen takes no responsibility for any loss due to cancellation of any events, or rent of replacement equipment or costs due to a third party's or customer's loss of profit, or any other indirect cost or losses however incurred.

Lab.gruppen reserves the right to make changes or improvements in design or manufacturing without assuming any obligation to change or improve products previously manufactured.

This warranty is exclusive, and no other warranty is expressed or implied. This warranty does not affect the customer's statutory rights.

8.2 International Warranties

Please contact your supplier or distributor for this information, as rights and disclaimers may vary from country to country.

8.3 Technical Assistance and Service

8.3.1 International Service

If your Lab.gruppen product requires repair, contact your Lab.gruppen dealer or distributor, or contact Lab.gruppen by fax or email to obtain the location of the nearest authorized service centre.

8.3.2 Factory Service

In the event a Lab.gruppen product requires factory service, you may contact Lab.gruppen's service department for return instructions and a Return Authorization number.

Please note for product return:

1. Use the original packing.
2. Include a copy of the sales receipt, your name, return address, phone and fax number, email address and description of the defect.
3. Mark the Return Authorization number on the outside of the packing.
4. Ship the product prepaid to:

Lab.gruppen
Faktorvägen 1
SE-434 37 Kungsbacka
SWEDEN

Phone: +46 300 56 28 00
Fax: +46 300 56 28 99

service@labgruppen.com
www.labgruppen.com

8.4 Trademarks

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WWW.LABGRUPPEN.COM